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Target students grades 6-8

Objectives

Students will be able to explain how scientists talk about life

Students will be able to identify and characterize living verses nonliving things in their lives

Students will be able to talk about how scientists use instruments to extend their senses when searching for life outside of ‘earth.

Students will be able to make observations that help them to distinguish between living and nonliving components in a new system

Background

Astrobiology is the study of life in the universe. Though it is only within the past center] century or so that the discipline has matured in to a robust science, figures like Aristarcus and Giordano Bruno have imagined that the stars in the night star could be suns in their own right, warming and brightening the planets of creatures far away. In this activity, students will get a taste of the kinds of questions that astrobiologists ask, and what we look for when searching for life in distant places by performing a mini NASA mission of their own

Engage

The lesson starts with photographs and artist concepts from worlds appreciated by astrobiologists. This serves both as an informal formative assessment. What do students know about space and moves into some of the work being conducted by scientists.

Explore

Students will be looking for life on 4 target planets, but first, they have to know what life is, and what it isn’t.

They’re split into teams and asked to identify living things, and nonliving things along with the characteristics that make up both.

Explain

The large group will gather back together to discuss ideas. The mentors will ask teams to come up with things that have living characteristics, but don’t fit on the living list. Lead scientists will explain that researchers don’t have one definition for life that they agree on. Living things cannot be categorized by one characteristic, and that there are some things that though they are not alive, display some of the characteristics of living things.

Expand

Mentors will introduce the target worlds where the teams will be looking for life. They will share how scientists use instruments like telescopes and spectrometers to extend their senses. Students will receive samples from each planet. They will make observations at once, after reconstituting their samples, and again in 5 minutes.

Evaluate

Students will present their observations sample by sample. Lead scientists will review living characteristics and definitions made previously. Students will decide if any of their samples contain living organisms. Leads will provide sample contents.

Mission Brio

IN the year 2042, NASA launches its Brio mission. The spacecraft Aristarchus, named for the philosopher of Samos journeys to 4 distant worlds that researchers suspect may be harboring microbial life. Mission scientists(students) have met up with Aristarchus, and its payload of data in deep space. Together, they, and lead scientists(mentors) will examine the data, to see if any of the worlds is home to living organisms.

Materials

4 small cups per set of students 9 oz is ample room

4 colors of sand, enough to cover the bottom of each cup, approx. 1 quarter cup

Alka celzer, or comparable fizzing tablets 1 per set of students

3 tsp sugar per cup

Salt

Active dry yeast

Marker for identifying cups

Spoons for stirring at least one per set of samples/at least 4

Container of hot water between 105 and 114 F warm/hot tap

Recommended set up

Mark cups A through D

Cover bottom of cup with corresponding single-color sand

Add 1 tsp salt to cup b

Crush and add one antacid tablet to cup C

Add 1 tsp dry active yeast to cup D

To all cups, add 3 tsp sugar

Stir to mix, making sure not to cross contaminate

Set up a tray for each student containing one of each sample, and a cup of warm water

Procedure

Start the activity by showing photos from NASA missions, anything you think will capture attention. Ask what they think the photos depict. Discuss what students know about space, and transition into the work being done by NASA. For example, Mars, Titan, and Enceladus. What is similar to earth? What features are unique?

Introduce Brio mission and tell students that no matter which talents they have, today they are all going to be astrobiologists. Ask what they think those scientists do. Explain that today they are going to journey to new worlds, to see if there is life, but first they have to know what they are looking for. How? What is alive?

Split students into teams. Ask them to think among themselves. Come up with at least 5 things that are alive, and 5 things that are not alive. And list how they know. What are characteristics of living things, of nonliving things?

Ex cat hamster human fish lobster move eat grow breathe reproduce respond

broom rock table rug bed still doesn’t

Gather back. Go over ideas. Write on board. Are their any things they can think of that have characteristics of living things, but aren’t alive?

Ex crystals, cars, robots, computer programs, viruses

Explain how scientists don’t agree on one definition for what is alive. There isn’t one characteristic that all living things have, and some nonliving things can have similar features.

Show students the planets they are going to explore for life. Pick colorful fun planets with fun names, explain to students how scientists use telescopes and other instruments to extend their senses, ex telescopes to see far, or spectrometers to smell, or telescopes to hear.

Have a mentor pass out samples. Be clear in the rules. Contents stay in the cups, unless otherwise instructed. There will be no eating or touching of anything in cups.

Have students make observations write on board cup by cup. Smell, warm? See? Sound?

Add the water to reconstitute dormant samples.

Make and share observations.

While the samples continue to react, discuss astrobiology topic of choice.

Ex current exoplanets, or how geological processes can be mistaken for life

After about 5 minutes has elapsed, ask students to make final observations.

Go back to the characteristics of life from earlier. What did students see? Do any match? Explain.

Do any cups contain life? Ask students why they think so.

Cup D had living things. Cup C fizzed, but it stopped. Cup D smelled, was warm, fizzed, and continued to do so.

One of life’s hallmarks is that it does something and continues to do it.

The spectroscopic data is in. Show students the instrumental analysis of what was in each cup.

Sample A

SiO4 silicate minerals sand

H2O dihydrogen monoxide water

C6H22O11 sucrose sugar

In addition

Sample B

NaCl sodium chloride salt

Sample C

Citric acid and bicarbonate mixture alka celzer

Sample D

Resembling saccharomyces cerevisiae yeast